

# Innovative Agroforestry Systems For Biofuel Production and more Sustainable Landscapes: Green Lands, Blue Waters in Minnesota

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Mid American Agroforestry Working Group (MAAWG)

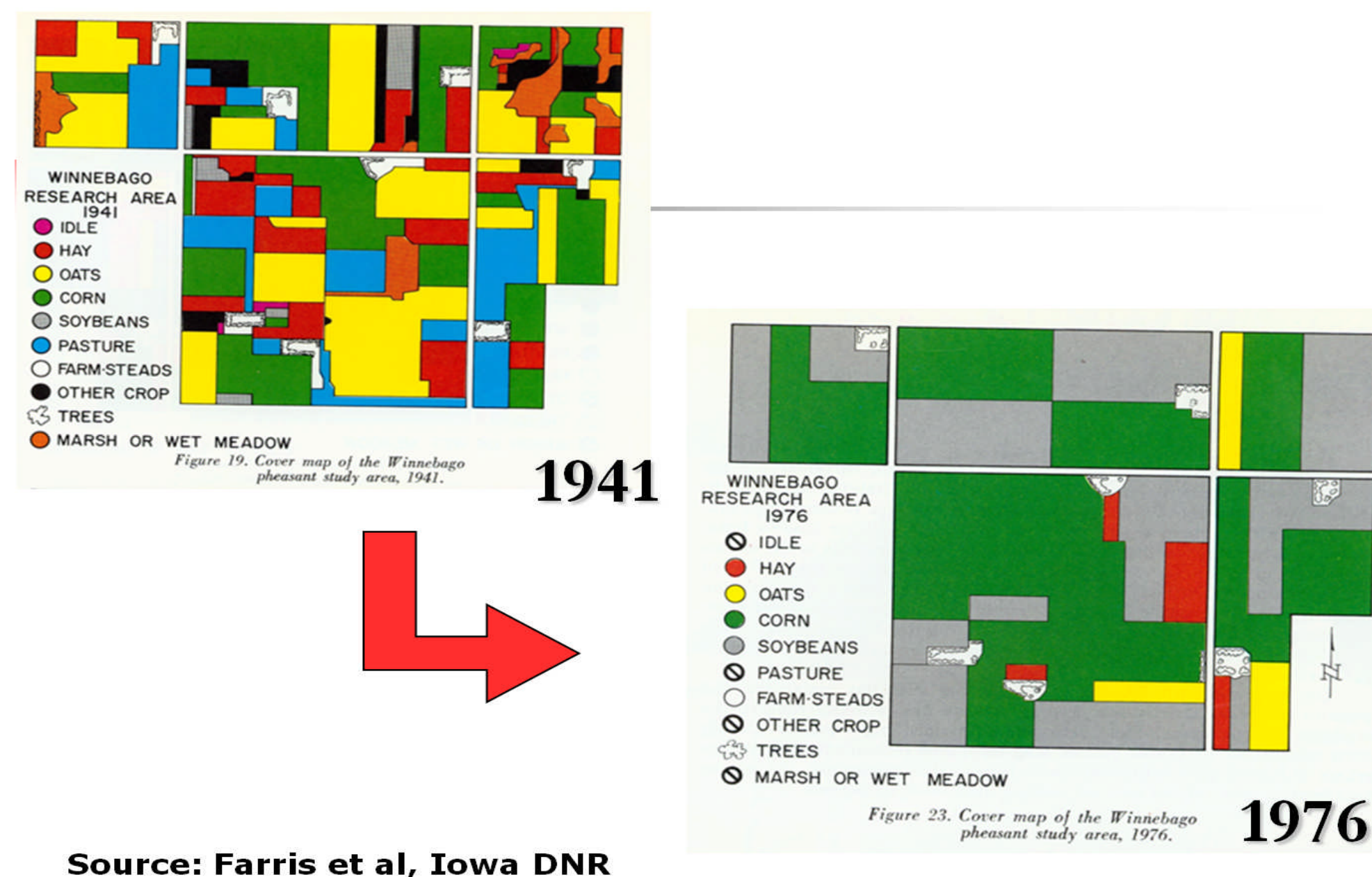
Options (examples):

## Problems:

- High levels of nutrients and chemicals in the Minnesota River moves to the Mississippi River and eventually the Gulf of Mexico.
- Hypoxic “dead zone” in the Gulf of Mexico
- Water quality, flooding, loss of recreational use and actual and potential health problems
- Minnesota River Basin is one of 20 rivers in America ranked as seriously threatened by pollution. (MPCA)

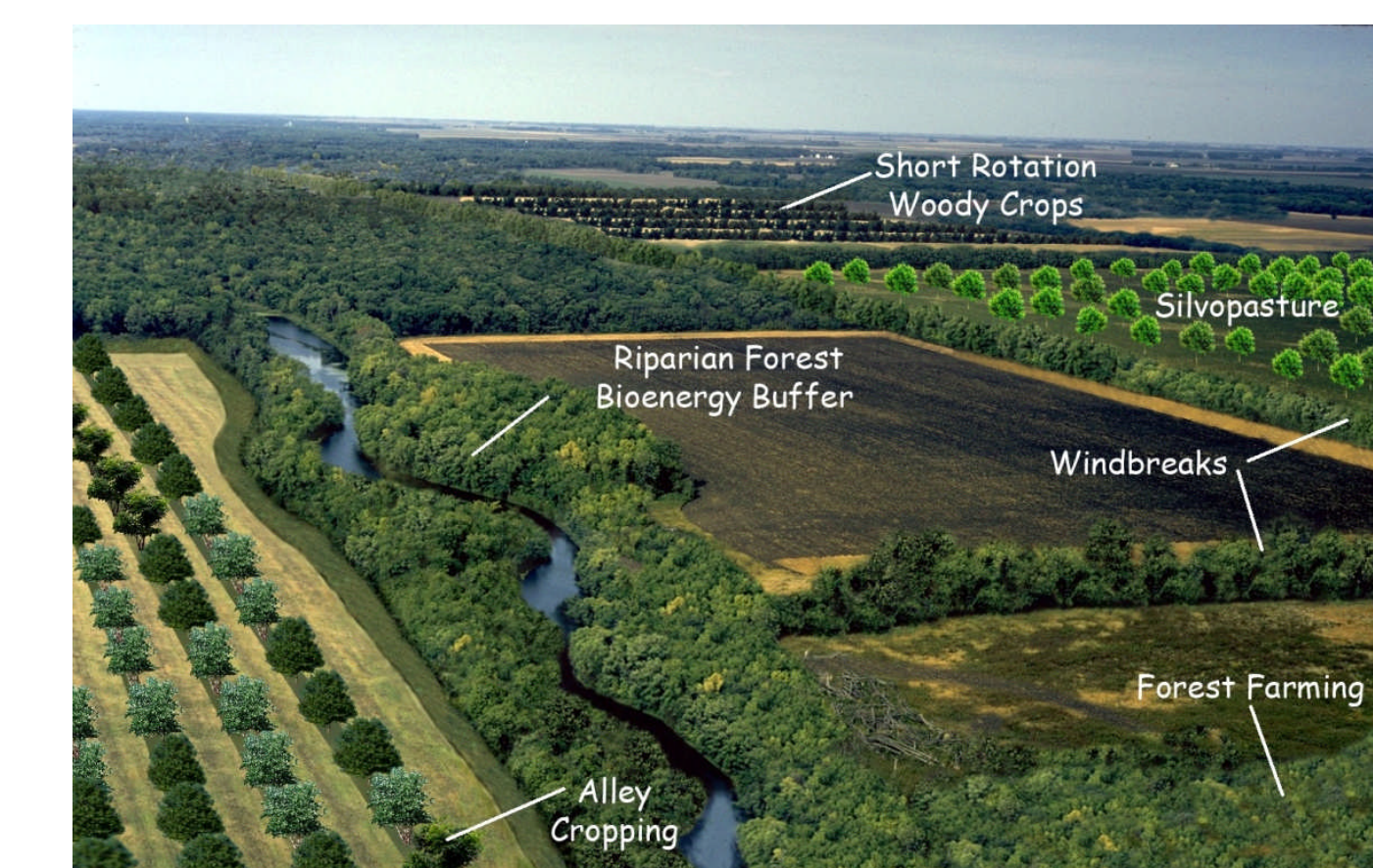
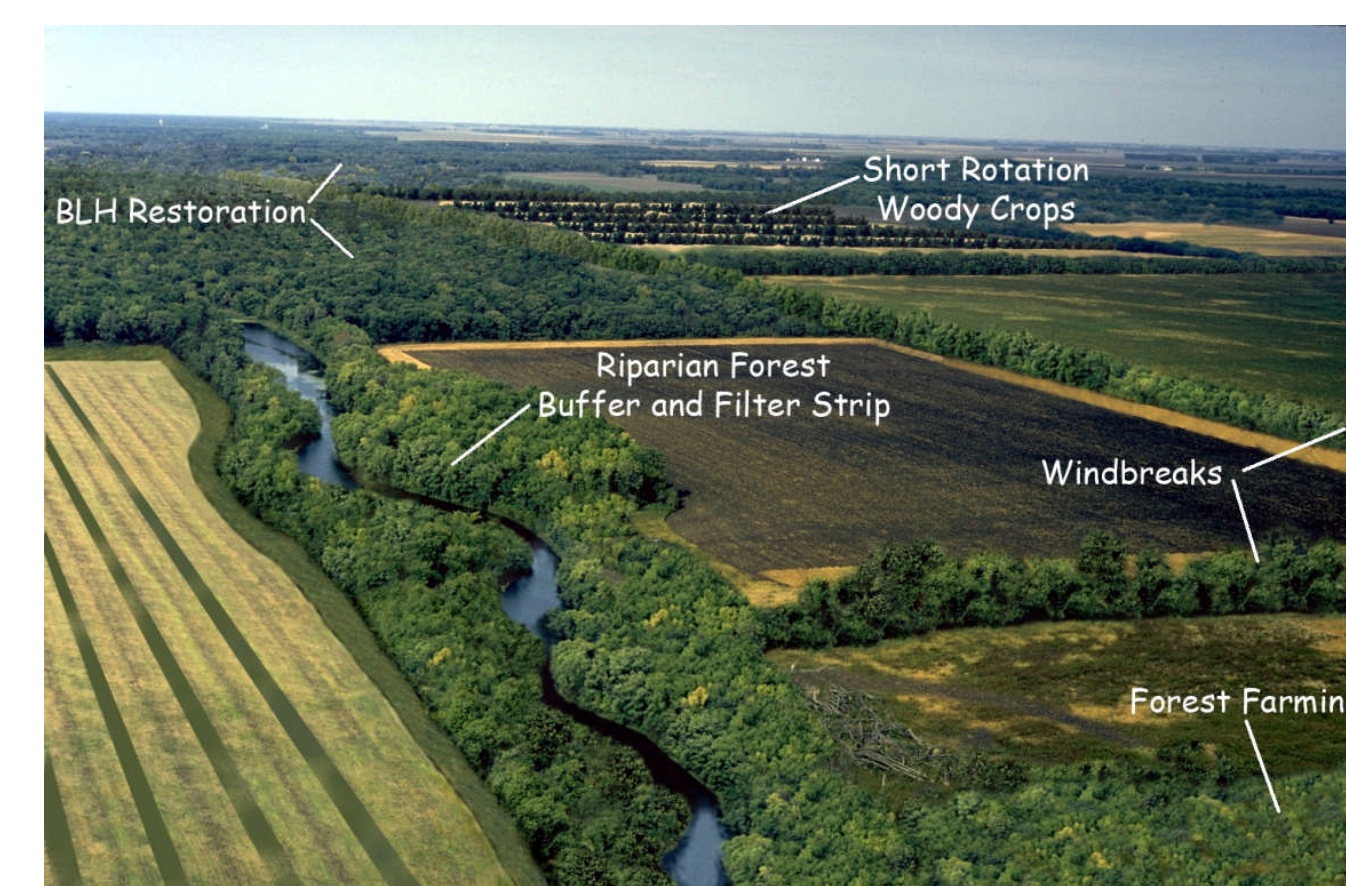
## Roots of the Problem:

- Changing landscapes – loss of diversity (see figure below)
- Dependence on two annual crop system – relatively short period when plants are growing and taking up water and nutrients.
- Widespread agricultural drainage – drainage has removed wetland complexes that stored water on the landscape and allowed natural processes to remove nitrogen from the water.
- Agricultural drainage has sped the delivery of water to streams and rivers leading to greater in channel erosion, bank slumping and bank erosion.



**Agroforestry, continual cover and perennial cropping systems can help address many of these problems. Perennial crops require fewer inputs and provide a more continuous cover to take up excess nutrients and protect the soil.**

How can we go from this



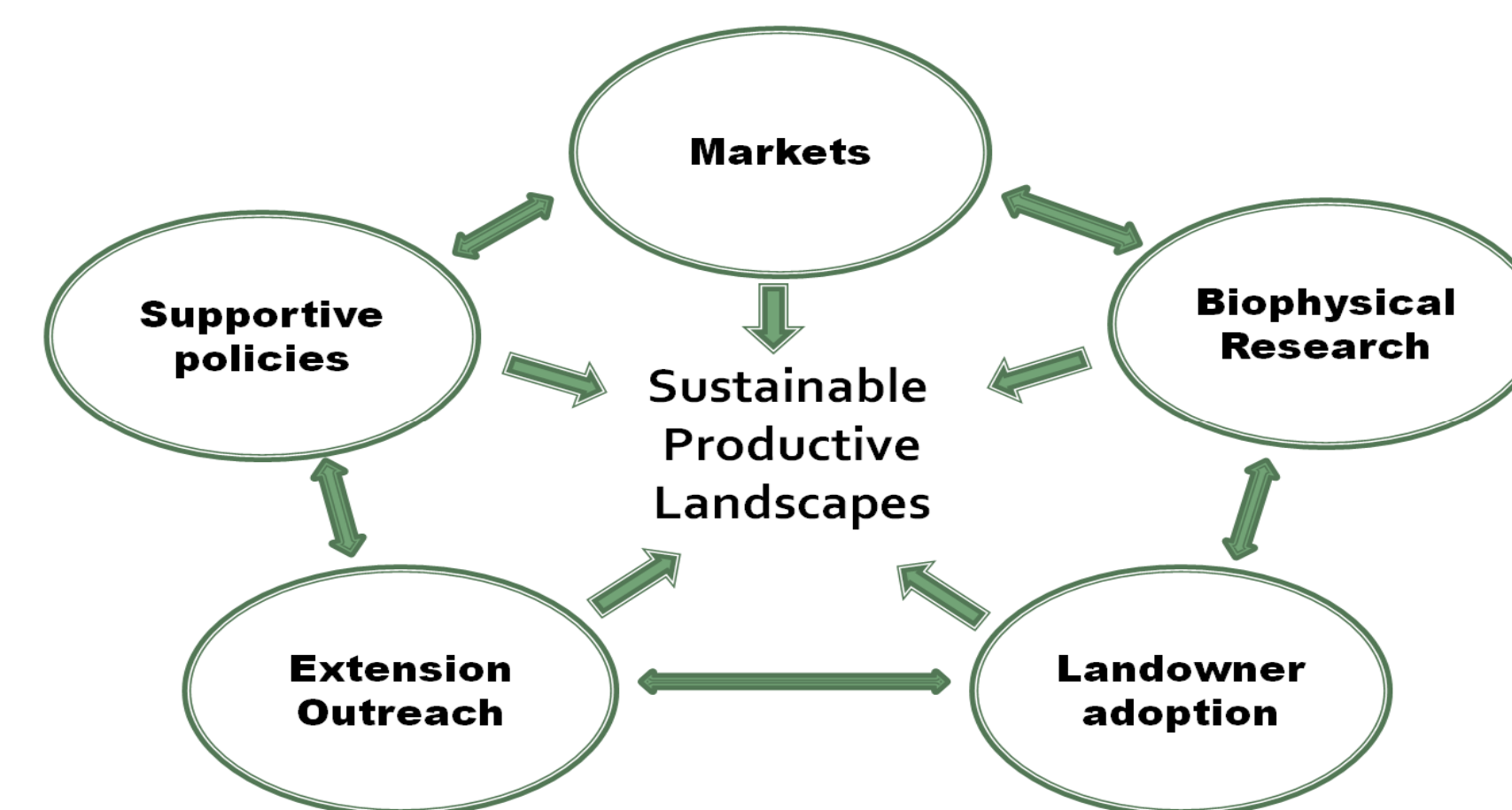
....to this?

## Approach:

Working with an interdisciplinary team, we undertake research that addresses the myriad factors that influence the ability to get agroforestry and perennial cropping systems on the landscape:

• **Biophysical research:** This includes research on plant breeding and the production and processing of alternative crops for food and fuel. Since we are often dealing with crops relatively new to current landowners, we need to understand how to manage those crops for production and ecosystem services.

The other part of this research is hydrological research to determine the impacts of perennial cropping systems on water quality and storage.



• **Landowner adoption:** In order for alternative cropping systems to have impact they must be adopted by landowners. We work with landowners to identify constraints to adoption and look for ways (subsidies, policies, etc.) to address them.

• **Markets:** A major constraint to adoption is the lack of markets for products from more sustainable options or inability to compete with the profit from annual cropping systems. Our research includes supply chain analysis to more efficiently produce & process alternative crops but also the potential of payments for ecosystem services to make alternative crops more competitive.

• **Policy:** Government policy often favors commodity crops with price supports and subsidies while alternative crops often do not have that support. We work with stakeholders and agencies that help set policy to suggest policy approaches that might favor more sustainable cropping systems.

• **Extension and outreach:** We work closely with UMN Extension, NGO's and Soil and Water Conservation Districts in our project areas to assist with dissemination of information generated by research as well as a link to interested farmers/landowners who often partner on research.

**Integration of our work across disciplines is key to developing cropping systems that are productive, adopted and that generate ecosystem services**

- **Bigger, better biomass buffers for biomass for energy:** We have large areas of floodplains that flood periodically leading to the loss of crops, insurance payments and other damages. Woody biomass crops resistant to flooding would avoid those losses and improve water quality. Tree crops providing food are another option.
- **Cover crops:** Cover crops can provide continuous cover in annual crop systems and may be required for short rotation woody crops that are kept weed free in their first years. Research has shown high runoff from plots with hybrid poplar and willow.
- **Hazelnuts:** Hazelnuts are a crop suited to smaller farms with a fairly diversified market. They show good potential in Minnesota and over a fairly large area. Work is ongoing to develop germplasm for more consistent and higher producing varieties. Results are currently variable.
- **Grass/SRWC alley cropping:** Combining SRWC's and grasses in strips helps address runoff issues in younger SRWC systems and provides a more diverse system.
- **SRWC's:** Short rotation woody crops show promise for biomass plantings and, in the case of hybrid poplar, can also be used for pulpwood as is the case in Minnesota. Ongoing research is looking at alley cropping systems and potential cover crops that could be used with SRWC's.
- **Perennial grasses and grains:** Perennial grain breeding is approaching the point where it can be cost competitive with annual grains and there is a growing interest in perennial grains from the market. Perennial grasses are being promoted for biomass for energy. There is ongoing research breeding perennial grains and grasses and developing appropriate cropping systems.

## Partners:

- **Green Lands, Blue Waters:** The mission of Green Lands, Blue Waters is to support development of and transition to a new generation of agricultural systems that integrate more perennial plants and other continuous living cover in the agricultural landscape.
- **Rural Advantage:** Rural Advantage's mission is to promote the connections between agriculture, the environment and rural communities in order to improve ecological health, economic viability and rural vitality.
- **Mid American Agroforestry Working Group:** The purpose of (MAAWG is to provide an organization for advancing the science, practice and adoption of agroforestry by landowners and natural resource managers in the Midwest region of the U.S.
- **Local, State and Federal Agencies:** Soil and Water Conservation Districts, MN Dept. of Natural Resources, MN Pollution Control Agency, Natural Resource Conservation Service, Forest Service, National Agroforestry Center, MN Board of Water and Soil Resources.
- **NGO's (local, regional, national and international):** Association for Temperate Agroforestry, Nature Conservancy, Pheasants Forever, Izaak Walton League, Institute for Agriculture and Trade Policy, The Land Stewardship Project, Rainforest Alliance, PRONATURA-Chiapas.
- **Business:** KODA Energy, Golder Associates Environmental Engineers, Hermes Floral.

Note: Visualization provided by Gary Bentrup of the National Agroforestry Center (NAC)